CHAPTER 2
SI APPROACHES

This chapter discusses approaches for conducting an SI. These include the focused SI, expanded SI, and single SI options. The focused SI tests PA hypotheses requiring further investigation and may be used to screen sites to determine the need for further Federal Superfund action. The expanded SI gathers information to fulfill HRS requirements for sites with a high probability of qualifying for the NPL. The single SI approach combines the functions of the focused and expanded SIs and may be chosen under certain conditions.

2.1 FOCUSED SI

The goal of the focused SI is to obtain and analyze environmental samples, to investigate human and environmental exposure to hazardous substances, and to test PA hypotheses that are the basis of the further action conclusion. Any of the following hypotheses, or any combination of them, can result in a PA further action decision.

- Release and migration (or threatened release) of a hazardous substance to drinking water wells or intakes.
- Release and migration of a hazardous substance to surface water sensitive environments or fisheries.
- Presence of a hazardous substance on residential, school, or day care properties or terrestrial sensitive environments.
- Release of a hazardous substance into the air.

Because these hypotheses are often based on professional judgement rather than analytical data, the focused SI emphasizes obtaining critical analytical data of waste and environmental samples that are usually not available during the PA. The focused SI should reflect the HRS significance of hazardous substance migration from sources at the site and contamination of targets.

As an example of how to test a PA hypothesis, consider the following situation:

> The PA for ZZ Metals, an abandoned plating facility, revealed that the only significant target is a shallow community well serving 50 people located 800 feet south of the site. PA investigators suspect that hazardous substances have migrated to this well, although no recent sample data are available to test this hypothesis.

The focused SI for ZZ Metals must include samples to test the PA hypothesis of contamination at the community well. Theoretically, this site could be screened from further Federal Superfund investigation by collecting only one sample from the well. If hazardous substances are not detected in that sample, the site would not score high enough for NPL consideration, regardless of other HRS scoring factors, such as waste characteristics. However, additional sampling will increase the degree of confidence in the conclusion and better characterize the site. Additional samples, for example from private wells, may be necessary to investigate public health and human exposure, even if contamination in those wells alone would not result in an HRS score greater than or equal to 28.50.

Collecting samples to characterize sources helps determine whether hazardous substances are actually associated with the site. Where a hazardous substance problem exists, source sampling identifies the specific substances at the site. If only low levels of hazardous substances are detected, investigators will have more confidence using other analytical results (e.g., from an uncontaminated community well) to screen the site. Conversely, if a specific hazardous substance is found in both the community well and site sources, target contamination can tentatively be attributed to the site.

The focused SI typically requires 12 to 20 samples (average 15) to investigate PA hypotheses of target

contamination and to determine the types of hazardous substances present at a site. The scope of a focused SI is defined by the number of critical hypotheses and questions remaining after the PA and the number of pathways contributing to the further action recommendation.

Conclusively attributing target contamination to the site or establishing the range of background levels for substances of concern are not necessary to test critical PA hypotheses and screen the site. The number of focused SI samples is typically less than the number of samples required to detect all hazardous substances present and to definitively attribute them to the site. More background, quality assurance, and quality control (QA/QC) samples may be needed to support HRS attribution requirements.

The hours to complete the focused SI varies with the amount of information available from the PA and the complexity of the site. On average, 350 to 450 technical hours are sufficient (Table 2-1). Most time will be spent preparing for the sampling visit and collecting samples in the field. At sites where the PA was conducted using the original HRS, additional hours will be necessary to update PA information and evaluate the site based on the revised HRS.

The investigator provides information to EPA officials at the end of the focused SI so that they may make one of three site disposition decisions:

- Site Evaluation Accomplished;
- Further action (e.g., expanded SI); or
- Schedule HRS package preparation if all necessary data are available.

To make a site disposition decision, EPA site assessment managers (SAMs) consider all data in light of the SI sample results to refine the site score developed at the PA. SAMs typically use EPA's *PREscore* computer program or SI worksheets to generate the site score for the focused SI. If PA hypotheses are confirmed, the SI site score will be high enough to warrant the expanded SI or preparation of the HRS package, since the threat or potential threat to human health or the environment can now be established. Otherwise, the site can be eliminated from further Superfund consideration at this time.

In most cases, a focused SI site score greater than 28.50 will approximate or represent a complete HRS site score that will be high enough for NPL consideration. However, in some instances, the focused SI score may be based on assumptions that have not been fully explored within the limited scope of a focused SI. Further investigation may change the site decision from further action to SEA. This can occur, for example, when hazardous substances detected during the focused SI at target locations are presumed to be from the site, but samples during the expanded SI reveal they are not attributable to the site. If attribution to the site is questionable or levels of contamination are very low, site assessment staff experienced in the HRS should review the analytical

TABLE 2-1: HOURS TO COMPLETE FOCUSED SI TASKS

Task	Hours	Percent
PA review and work and sample plan development	50	12.5
Mobilization, travel, and demobilization (1 to 3 days, 3 to 5 team members	150	37.5
Sampling and data collection (generally not for all four pathways)	120	30.0
Report preparation, HRS evaluation, and reviews	80	20.0
Total	**400**	**100.0**

results and site score to make sure an expanded SI is warranted. This review also will help define activities and objectives for the expanded SI.

2.2 EXPANDED SI

The objective of the expanded S1 is to collect all data necessary to prepare an HRS scoring package to propose the site to the NPL. To fully evaluate the site and to fulfill HRS package documentation requirements, the SI investigator should:

- Investigate and document critical hypotheses or assumptions not completely tested during the focused SI.
- Collect samples to attribute hazardous substances to site operations.
- Collect samples to establish representative background levels.
- Collect any other missing HRS data for pathways of concern.

When environmental samples do not provide the information needed for HRS documentation requirements, investigators also may need to perform special field activities. The purpose of these procedures, which are beyond the screening scope of the focused SI, is to supply data to refine and document the site score. Special expanded SI field activities may include monitoring well installation, air sampling, geophysical studies, drum or Link sampling, borehole installation, and complex background sampling studies.

The expanded SI typically requires 25 to 35 samples (average 30) and 600 to 650 technical hours (Table 22). The complexity of the site and the need for special procedures will determine the scope of the investigation and whether additional technical hours are required.

Sampling during the expanded SI should be designed to support and document HRS requirements, including 1) observed releases of hazardous substances relative to background, 2) observed contamination, and 3) levels of contamination. The expanded SI investigator should collect a complete set of QA/QC and background samples to fully and confidently document and attribute releases to the site.

To illustrate the difference between expanded SI and focused SI sampling, again consider the ZZ Metals Site:

> Focused SI sampling results showed high levels of phenol in the community well 800 feet south of the site and in sources at the site. However, wastes containing phenol are also associated with a second facility 600 feet southeast of the community well.

The expanded SI should investigate whether contamination in the community well can be attributed to ZZ Metals. This would require sampling selected wells located between ZZ Metals and the community well, plus additional wells between the

TABLE 2-2: HOURS TO COMPLETE EXPANDED SI TASKS

Task	Hours	Percent
Previous investigation review (PA, focused SI) and work and sample plan development	130	20
Mobilization, travel, and demobilization (2 to 3 days, 5 team members	150	25
Sampling and data collection (generally not for all four pathways)	240	40
Report preparation, HRS evaluation, and reviews	100	15
Total	**620**	**100**

An expanded SI is not necessarily larger in scope than a focused SI. The scope of an expanded SI depends on the HRS data gaps remaining after all previous investigations.

community well and the second facility. If no wells exist in these areas, ground water monitoring wells should be installed to determine whether ZZ Metals is contributing, at least partially, to the contamination of the community well.

The expanded SI also differs from the focused SI by emphasizing collection of all missing non-sampling information for pathways of concern. These data may be used to support previous documentation or references, fulfill remaining HRS data requirements, and identify other sources of contamination in the site vicinity. Table 2-3 compares focused SI and expanded SI data collection activities.

At the end of the expanded SI, the investigator prepares a report of all expanded SI findings and analytical results. Per EPA Regional and State instructions, the investigator should evaluate all site data according to the HRS. If the site is to be proposed for the NPL, assembling an HRS package will be scheduled. The HRS package consists of the HRS documentation record, reference materials, HRS scoresheets, and site narrative summary along with other administrative requirements as specified in *Regional Quality Control Guidance for NPL Candidate Sites* (OSWER Directive 9345.1-08, 1991). Preparing the HRS package is not part of SI activities; however, all data necessary to document an HRS score should be collected during the expanded SI.

2.3 SINGLE SI APPROACH

Investigators may consider performing a single SI if the quality of available data and site characteristics strongly indicate a significant threat. Another consideration to perform a single SI is whether all data necessary to document an HRS score can be collected efficiently at one time. A complex site may require a two-stage field investigation even if it is clearly an NPL candidate. For such a case, the investigator should restrict the scope of the focused SI to obtaining data needed to support efficient future sampling and to address HRS documentation requirements.

TABLE 2-3: TYPICAL SI DATA COLLECTION ACTIVITIES

Activity	Focused SI	Expanded and Single SI
Non-sampling data collection	T	T
Target sampling	TT	TT
Source sampling	TT	TT
Release sampling	T	TT
Background sampling	T	TT
Attribution sampling	–	TT
QA/QC sampling	T	TT
Special data collection or sampling tasks	–	if necessary

Key: TT = Major activity
T = Minor activity

If the complexity of the site does not preclude a single phase field investigation, and if previous data fulfill the screening functions of the focused SI and indicate that the site will score high enough for NPL consideration, the focused SI may be bypassed. However, if conclusions are drawn exclusively from sample results, the investigator must be sure that previous analytical data are of sufficient quality to support the conclusions (see Section 3.5.2). Sample locations, sampling protocols, analyzed substances, and data validation procedures all influence how previous analytical data can be used at the SI (e.g, for HRS scoring, testing PA hypotheses, sample planning). Figure 2-1 outlines basic selection criteria for a single SI. Site conditions consistent with a single field investigation are discussed below.

Sites with Available Analytical Data: Municipal, county, State, or Federal authorities may have conducted prior sampling investigations at some sites. The effect this information may have on the scope of the Sl depends on their quality (see *Guidance for Data Useability in Site Assessment*, in development) and whether they support or refute PA hypotheses. If previous analytical data clearly demonstrate that the site score will be high enough for NPL consideration, a single SI may be conducted, unless the complexity of the site dictates iterative sampling.

"Simple" Sites: Some sites have characteristics that simplify the HRS evaluation. For "simple" sites, it may be possible to compile all data necessary to prepare an HRS package (i.e., expanded SI objective) within the focused SI sampling budget. This is true for sites with:

- Well-defined source and waste characteristics
- No other potential sources of contamination in the area
- One pathway of concern
- Few targets requiring sampling

In a few cases, even in the absence of analytical data, site characteristics are well-defined at the PA stage. These sites may qualify for NPL consideration with limited sampling. For example, if the site historically operated as a wood treatment facility and is located immediately adjacent to surface water used by fishermen, a single investigation may be a reasonable approach. In this situation, it may be possible to characterize threats to the surface water pathway with a relatively limited investigation.

Remote Sites: Investigations at some sites require considerable travel because of remote locations. Travel-related activities often account for as much as 40 percent of the budget for such investigations. At sufficiently remote sites, a single SI may be cost-effective, provided a second site visit will not be necessary later to collect missing data.

Potential Contamination Sites: Some sites are recommended for further action after the PA because the targets subject to potential contamination are significant. If available information indicates a strong likelihood of a release, the focused SI may be bypassed if the site score will be high enough for NPL consideration based on potential to release or an observed release only (as opposed to actual contamination).

FIGURE 2-1: SITE INSPECTION DECISION TREE